

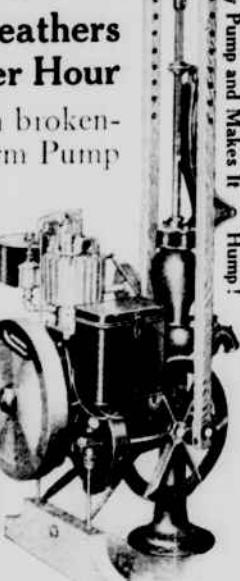
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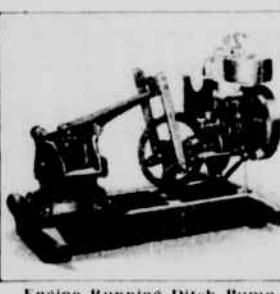
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chance to rectify matters. Next time his opsonic index is above normal again. Next time, perhaps, it is up to 1.42. And if it stays there for a couple of months the patient is safely on the road to recovery. His body has immunized itself against tuberculosis, and if he is careful to keep in good condition the disease will never more bother him.

All Cleared Up

AGAIN, in the use of vaccines the opsonic index is of vast value. Long experience showed that a vaccine, when it was injected into a patient's veins, produced at the start not immunity, but greater ability to disease. Thus, Dr. Wright noted that when efforts were made to cure boils by inoculating patients with attenuated staphylococci, the first result was to increase the number of boils. This puzzling manifestation he called the negative phase, and as a rule it was followed by a positive phase, during which the boils began to disappear. But there was nothing certain about it, and physicians were much puzzled.

The opsonic theory clears it all up. When, in an effort to stimulate his opsonins to activity, a horde of half dead bacilli are introduced into a man's veins, they give his opsonins and leucocytes a hard tussle, even though they have no hope of winning, and so his opsonic index drops to far below normal. Then, as his white corpuscles are stimulated and begin to work in earnest, it rises to normal, and in the end goes higher than normal. It is then that the vaccine is beginning to do its work of immunization.

Now it is obvious that by studying a man's opsonic indices it is possible so to arrange the dose of vaccine that the negative phase is very short, and so to gage and time subsequent doses that the opsonic index, after it has once got above normal, will never fall lower again. This possibility is of enormous importance, because it makes the use of vaccines exact and scientific, instead of haphazard and inaccurate, as in the past.

When Koch perfected his tuberculin, as we have seen, experience showed that it often made patients worse instead of better, and so it was denounced as a fraud. In the light of Dr. Wright's researches this is now known to have been due to the fact that Koch and his disciples used excessive doses, which produced such violent negative phases that the secondary positive phase never appeared. Soon, I believe, it will be possible to conduct the whole operation with exactness: to employ just the right amount of tuberculin, and to observe its effects from hour to hour. Indeed, Dr. Trudeau and others are even now engaged in perfecting the process.

How Diseases Are Combed

WHAT is true of tuberculosis is true of all other diseases caused by specific organisms. Today we combat them in one of three ways: we try to kill the germs; we try to neutralize their poisons; or we try to steel the body against the effects of one or both. In the past we have had to depend upon general appearances to determine the measure of success. Thus, if a man had a certain disease and we made an effort to kill its germs, and he got well, we concluded that the means we employed were successful. As a matter of fact, our germ killing device may have been a failure, and the man may have got well through his own efforts, and without its aid, or even in spite of its possible damage.

The opsonic method will clear away this haziness. It will enable us to determine with some accuracy whether a given remedy has any effects upon a given germ, and to determine the precise nature of this effect. It will enable us to discover exactly what action this remedy has upon normal and diseased white blood corpuscles. It will enable us to determine how large a dose is indicated under given conditions. It will enable us to avoid treatment that, while seeming to benefit, really causes damage. It will enable us to fix with some exactness a patient's degree of immunity, and to find out whether this immunity is increasing or decreasing. And so it will show us when to aid his leucocytes in their fight, and when to avoid the risk of handicapping them. In a word, it will give us a method of approaching an infectious disease with some approach to the certainty we now exhibit in approaching a surgical operation.

In the preparation of antigen serum and poison-neutralizing antitoxin, the opsonic method will be extremely valuable. At present when we seek to prepare a serum to combat the germs of some definite disease, we commonly select some lower animal—usually a horse—inoculate it with the germs, or toxins, wait until it seems to recover, and then inject its apparently germ-proof or toxin-proof blood serum into our human patient. This procedure is theoret-

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